

Shri Shivaji Science and Arts College, Chikhli.
Department of Chemistry
Program Outcome, Program Specific Outcome and Course Outcome

Program Outcome

After successful completion of three year degree programme in chemistry (B.Sc.), a student should be able to

- PO-1. Demonstrate, solve and understanding of major concepts in all disciplines of chemistry.
- PO-2. Solve the problems and also think methodically, independently and draw a logical conclusion.
- PO-3. Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.
- PO-4. Create an awareness of the impact of chemistry on the environment, society and development outside the scientific community
- PO-5. Find out the green route for chemical reactions for sustainable development.
- PO-6. To inculcate the scientific temperament in the students and outside the scientific community.
- PO-7. Use modern techniques, decent equipments and chemistry softwares.

Programme specific outcomes

- PSO-1 Gain the knowledge of chemistry through theory and practicals.
- PSO-2 To explain nomenclature, stereochemistry, structures, reactivity and mechanism of chemical reactions.
- PSO-3 Identify chemical formulae and solve numerical problems.

- PSO-4 Use modern chemical tools, models, chem-draw, charts and equipments.
- PSO-5 Know structure activity relationship.
- PSO-6 Understand good laboratory practices and safety
- PSO-7 Develop research oriented skills.
- PSO-8 Make aware and handle the sophisticated instruments, equipments.

Course Outcomes of B.Sc.-I Sem.-I

Course: 1S Chemistry

After successful completion this course, students will be able to know :

- CSO-1. Different periodic properties of elements.
- CSO-2. Periodic trends of atomic and ionic radii, Ionization energy, electron affinity and electronegativity.
- CSO-3. Definition of ionic bonding, Factors affecting on ionic bond formation, Born-Landé equation to calculate Lattice energy, Born Haber cycle to determine lattice energy, Solvation and solvation energy.
- CSO-4. S block elements and P block elements
- CSO-5. Inductive effect, Electromeric effect, Resonance effect, Hyperconjugation.
- CSO-6. Reactive intermediates Carbocations, Carbanions and free radicals.
- CSO-7. Aliphatic Hydrocarbons – Alkanes, Alkenes, Alkynes and Alkadienes
- CSO-8. Aromatic Hydrocarbons – structure of benzene, Reactivity of benzene and orientation of benzene.
- CSO-9. Thermodynamics – Adiabatic and Isothermal process, Statement of First law of thermodynamics, Need of Second law of thermodynamics.
- CSO-10. Concept of entropy, Physical significance of entropy, entropy of fusion, sublimation, vapourisation, transition and its calculation.
- CSO-11. Gaseous state – Postulates of Kinetic theory of gases, RMS, average and Most probable Velocity.

- CSO-12. Phase Rule – Statement of Phase rule, explanation of phase rule, Number of components and degree of freedom, Applications of Phase rule to water and Sulfur dioxide.

Course : 1S Chemistry Practical

After successfully completing this course, students will be able to know :

- CSO-1. Detection of Acidic and Basic radicals from given inorganic mixture.
CSO-2. Preparation of acetamide, benzanilide, Phenyl azo dye, tribromoaniline, benzoic acid.

Course Outcomes of B.Sc.-I Sem.-II

Course: 2S Chemistry

After successful completion and studying this course, students will be able to-

- CSO-1. Understand the concept of polarisation and Fajans rule with its application.
CSO-2. Describe the covalent bond and hybridisation and its types.
CSO-3. Discuss the concept of acids and bases, classify hard and soft acids.
Apply Pearsons HSAB or SHAB principle to acids and bases.
CSO-4. Compare the study of p-block elements of group 16 and 17 with reference to different periodic properties.
Interhalogen compounds, their structure and properties and introduction of Fluorocarbons.
CSO-5. Study noble gases, compounds of noble gases with their structure and bonding.
CSO-6. Discuss non-aqueous solvent, water as Universal solvent with different parameters. Liquid ammonia as solvent with its merits and de-merits.

- CSO-7. Explain different methods of preparations of alkyl and aryl halides with different chemical reactions and comparison of reactivity. Benzyne intermediate mechanism.
- CSO-8. Study alcohols- Methods of preparation, reactions and uses of dihydric alcohol. Pinacol-pinacolone re-arrangement mechanism.
- CSO-9. Co-relate and study phenols, ethers and epoxide. Their methods of preparation with specific name reactions-like Williamsons synthesis, Fries-rearrangement, Kolbe's reaction. Ring opening reaction of epoxides.
- CSO-10. Understand electrical and magnetic properties with their application.
Study the types of magnetic properties.
Study Gouy's balance method. Application of magnetic moment for identification of molecular structure with different numericals .
- CSO-11 Visualise and discuss the concept of chemical kinetics.
Study terms involved in it. Half life period, order of reaction with examples.
Determination of order of reaction using different methods like- vant-Hoff's method, Ostwald's method.
Activation energy and Arrhenius equation with numericals.

Course : 2S Chemistry Practical

After successful completion of this course, students will be able to know :

- CSO-1. Systematic analysis of organic compound under following heads:
Preliminary test, element detection, functional group, melting /boiling point and preparation of derivative with its melting point.
- CSO-2. Determination of surface tension by stalagmometer.
- CSO-3. Determination of coefficient of Viscosity of unknown liquid by Ostwald's Viscometer method.
- CSO-4. Comparison of cleaning power of detergents sample by stalagmometer.
- CSO-5. Determination of parachor value of $-\text{CH}_2-$ group by stalagmometer.

CSO-6. Determination of heat of solution of KNO_3 solution.

Course Outcomes of B.Sc.-II Sem.-III

Course: 3S Chemistry

After successfully completing this course, students will be able to know :

- CSO-1. Molecular orbital theory, Concept of bond order, MO structure of homonuclear diatomic molecule, Comparison of VB and MO theory.
- CSO-2. Free electron theory and properties of metals, Resonance theory of metals
- CSO-3. Various rules under VSEPR theory to explain molecular geometry
- CSO-4. Volumetric analysis, Molarity, Normality, Types of acid and base titration
- CSO-5. General principles involved in redox titration, Iodometric estimation of Cu(II)
- CSO-6. Theoretical principles underlying various steps involved in gravimetric analysis, Estimation of barium as barium sulphate
- CSO-7. Preparation of acetaldehyde, benzaldehyde, acetone, acetophenone, structure of carbonyl group, reaction of aldehyde and ketones
- CSO-8. Structure and reactivity of carboxylic group, Preparation of oxalic acid, Lactic acid, Benzoic acid and their reaction.
- CSO-9. Element of symmetry, chirality, asymmetric carbon atom, enantiomers and diastereomers.
- CSO-10. Cis-trans and E-Z nomenclature, Methods of structure determination.
- CSO-11. Bayer strain theory, stability of cycloalkanes, conformational isomers
- CSO-12. Gibbs and Helmholtz's free energy function, partial molal function, Gibbs-Duhem equation.
- CSO-13. Nerst distribution law and its applications, Phase transition-Clausius-Clapeyron equation.

CSO-14. Surface tension and applications of surface tension, Viscosity and its applications

CSO-15. Conductance of electrolyte solution, Conductometric titration and its application, Determination of dissociation constant of weak electrolyte.

B.Sc.- II Sem.-III

Course : 3S Chemistry Practical

After successfully completing this course, students will be able to know :

CSO-1. Experiments related to Volumetric Analysis such as neutralizing capacity of antacid, the strength of oxalic acid, FAS, $K_2Cr_2O_7$, Percentage purity of FAS, Estimation of copper by iodometric titration.

CSO-2. Experiments related to Gravimetric analysis such as Estimation of Barium, Nickel, Iron.

CSO-3. Physical chemistry experiments such as determine refractive index, consolute temperature for phenol water system, Transition temperature of $MnCl_2 \cdot 4H_2O$, Kinetics of hydrolysis of methyl acetate, kinetics of saponification of ethyl acetate, determine partition coefficient of benzoic acid, Iodine, determine solubility of benzoic acid at different temperature and heat of solution.

Course Outcomes of B.Sc. Chemistry Semester- IV

After successfully completing this course, Students will be able to

CSO-1. Know characteristics of transition elements, general properties of transition elements with special reference to group trend, Comparison of 3d series element with 4d and 5d series element.

CSO-2. Know principle involve and factors affection in extraction of elements, Apply thermodynamic concept to reduction process (Ellingham diagram).

- CSO-3. Know special properties of lanthanides, Learn electronic configuration and oxidation state of Actinides, comparison of Lanthanides and Actinides.
- CSO-4. Know general properties of metallurgy.
- CSO-5. Know orbital picture, synthesis and reactions of naphthalene (Electrophilic Substitution), Preparation of naphthal and naphthalamine.
- CSO-6. Know synthesis and properties of malonic ester, Acetoacetic ester.
- CSO-7. Know constitution, structure of glucose and fructose, Epimerisation, Conversion of glucose to fructose.
- CSO-8. Know preparation of nitrobenzene, Reduction reaction of nitrobenzene in acidic, basic and neutral medium.
- CSO-9. Know basicity of amine compounds, Preparation and properties of aniline, Hoffmann exhaustive methylation and its mechanism.
- CSO-10. Know preparation of benzene dizonium chloride and its synthetic applications.
- CSO-11. Know classification, synthesis and properties of proteins.
- CSO-12. Describe colligative properties of dilute solutions with respect to elevation of boiling point, depression in freezing point, Explain abnormal behaviour of solution, Van't Hoff's factors (i), Determination of degree of dissociation and association from Van't Hoff's factors and to solve the numericals.
- CSO-13. Know type of symmetry, Laws of symmetry, Weiss and Miller indices of lattice planes, Calculation of h,k,l, Bravais lattice of SCC,BCC,FCC, Bragg's law, Method of determination of crystal structure of NaCl and KCl and to solve the numericals.

Course outcomes for B.Sc. Chemistry practical Semester- IV

After successfully completing this course, Students will be able to

- CSP- 1. Employ scientific knowledge for separation of binary mixture of Cu^{2+} and Ni^{2+} ions by paper chromatography and determination of R_f value.
- CSP- 2. Employ scientific knowledge for estimation of Zn^{2+} ion by complexometric titration.
- CSP- 3. Employ scientific knowledge for determination of strength of unknown calcium salt solution by complexometric titration.
- CSP-4. Employ scientific knowledge for estimation of hardness of water by complexometric titration.
- CSP- 5. Use modern technique for estimation of Cu^{2+} ion in CuSO_4 sample solution by spectrophotometry.
- CSP- 6. Employ scientific knowledge and good laboratory practice for isolation of casein from milk.
- CSP -7. Employ scientific knowledge and good laboratory practice for estimation of glucose.
- CSP -8. Employ scientific knowledge and good laboratory practice for estimation of acetamide.
- CSP- 9. Employ scientific knowledge for determination of equivalent weight of organic acid.

Course Outcomes of B.Sc. Chemistry Semester -V

After successfully completing this course, students will be able to know:

- CSO-1. Basic terms involve in coordination chemistry, Werner's theory.
- CSO-2. Nomenclature and isomerism in coordination compounds, Structure and bonding in complexes of 3d series elements.
- CSO-3 .Definition, classification and application of chelates.

- CSO-4. Crystal field theory, Crystal field splitting, concept of CFSE, High spin and low spin complexes.
- CSO-5. Electronic spectra of transition metal complexes, Calculation of ground term, Orgeldiagram of d1 and d9 complexes, Electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$.
- CSO-6. Stability of complexes, Thermodynamic and Kinetic stability.
- CSO-7. Orbital picture and substitution reaction of pyrrole and pyridine, Chemical reaction and orientation.
- CSO-8. Method of preparation and synthetic application of organomagnesium, organolithium and organozinc compounds.
- CSO-9. Retrosynthetic analysis and applications.
- CSO-10. Polymers, Dyes, Drugs and Pesticides.
- CSO-11. Quantum mechanics, Plank quantum theory, Photoelectric effect, Compton effect, de Broglie hypothesis, Heisenberg's uncertainty principle.
- CSO-12. Classical wave equation, Derivation of time independent Schrodinger wave equation, well behaved wave function.
- CSO-13. Application of Schrodinger wave equation, Concept of atomic orbital.
- CSO-14. .Molecular spectroscopy, Energy level diagram of molecule, Conditions and selection rules for rotational, vibrational and Raman spectrum.
- CSO-15. Pure rotational and vibrational Raman spectrum of diatomic molecule.

Course Outcomes of B.Sc. Chemistry practical Semester- V

After successfully completing this course, student will able to know:

- CSO-1. Preparation of tetraminecopper (II) sulphate, hexamine nickel (II) chloride, potassium trioxalatoaluminate (III), Prussian blue, chrome alum, sodium thiosulphate and dithionite, cuprous chloride.
- CSO-2. Estimation of acetamide, glucose, formaldehyde, nitro group, protein.

- CSO-3. Qualitative separation of mixture of dyes using TLC/ Paper chromatography.
- CSO-4. Demonstration of Steam Distillation.
- CSO-5. Conductometric titration of mixture of strong and weak acid against a strong base.
- CSO-6. Determination of dissociation constant of weak acid by conductometry.
- CSO-7. pH metric titration of strong acid against a strong base by computer simulation.
- CSO-8. Potentiometric titration of strong acid against strong base.
- CSO-9. Verification of Lambert- Beer Law using KMnO_4 / $\text{K}_2\text{Cr}_2\text{O}_7$ solution.

Course Outcomes of B.Sc. Chemistry Sem -VI

Course: 6S Chemistry Theory

After successfully completing this course, students will be able to know:

- CSO-1. Thermodynamic and kinetic stability of complexes and different factors affecting the stability of complexes
- CSO-2. Two types of substitution reactions shown by coordination compounds with their mechanisms viz. SN_1 dissociative mechanism and SN_2 associative mechanism
- CSO-3. Labile and inert complexes and the various factors affecting the lability of complexes
- CSO-4. Various regions of electromagnetic spectrum, phenomenon of coloration of complexes and laws of light absorption,
- CSO-5. Principle and applications of spectrometer, colorimeter and paper chromatography
- CSO-6. Metal carbonyls, Effective atomic numbers (EAN) rule, structure of metal carbonyls on the basis of VBT, concept of synergic bonding
- CSO-7. structure and bonding in silicon polymers, polyphosphazenes, role of bioinorganic molecules or trace elements in biological system

- CSO-8 Principle, instrumentation, solvent and application of electronic spectroscopy and IR spectroscopy in elucidation of unknown organic compound
- CSO-9 Principle, instrumentation and application of $^1\text{H-NMR}$ spectroscopy and mass-spectrometry in structural elucidation of given organic molecules
- CSO-10 Introduction to elementary quantum mechanics involving Planck's quantum theory, Heisenberg's Uncertainty Principle, de Broglie hypothesis, Photoelectric effect, Compton's effect, Schrodinger wave equation, wave function and concept of atomic orbitals
- CSO-11 Principle and application of pH-metry using different electrodes and about potentiometric titration
- CSO-12 Nuclear models, Meson theory, nuclear fission and nuclear fusion reactions, Q-value and application of radioisotopes for human welfare

Course: 6S Chemistry Practical

After successfully completing this course, students will be able to know:

- CSO-1 Estimation of organic compounds like glycine, formaldehyde, ascorbic acid, phenol from the given solution skillfully
- CSO-2 Handling of instruments conductometer, potentiometer skillfully and performed practicals by using these instruments.
